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SAL-AMMONIAC: A STUDY IN PRIMITIVE CHEMISTRY

BY

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Sal-Ammoniac: a Study in Primitive Chemistry.

By H. E. STAPLETON, B.A., B.Sc., (OXON), *Professor of Chemistry, Presidency College, Calcutta; late Officiating Principal of the Calcutta Madrasah.*

[Read, August 2nd, 1905.]

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The aim of the following paper is to convey some slight impression of the environment of the science of chemistry in its alchemical youth. For this purpose, a study is made of the history of the well-known substance Sal-Ammoniac, with the idea of throwing light upon the primitive conceptions of nature that led to its introduction as an alchemical drug.

Our earliest authority for the use of the term 'sal-ammoniac' is Pliny.[1] In his *Historia Naturalis*, XXXI, 39, the following statement occurs:—

"Invenit et [nativum salem] juxta Pelusium Ptolemæus rex, cum castra faceret. Quo exemplo postea inter Ægyptum et Arabiam, etiam squalentibus locis, cœptus est inveniri, detractis arenis: qualiter et per Africæ sitientia usque ad Hammonis oraculum. Is quidem crescens cum Luna noctibus. Nam Cyrenaïci tractus nobilitantur Hammoniaco et ipso, quia sub arenis inveniatur, appellato.[2] Similis est colore[3] alumini, quod schiston vocant, longis glebis, neque perlucidis, ingratus sapore, sed medicinæ utilis. Probatur quam maxime perspicuus, rectis scissuris. Insigne de eo proditur, quod levissimus intra specus suos, in lucem universam prolatus, vix credibili pondere ingravescat. Causa evidens, cuniculorum spiritu madido sic adjuvante molientes, ut adjuvant aquæ. Adulteratur Siculo, quem Cocanicum appellavimus: necnon et Cyprio mire simili. In Hispania quoque citeriore Egelastæ[4] cæditur, glebis pæne translucentibus, cui jampridem palma

[1] 23—79 A.D.

[2] Pliny thus derives the name of the salt from ἄμμος, sand, and not from the name of the god Ammon.

[3] 'Canescens' (*Hist. Nat.*, XXXV, 52, Harduin's ed., Paris, 1685).

[4] To the present day, common salt forms a large item in the exports of Spain; and a mountain of rock salt still exists at Cardona in the province of Barcelona.

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a plerisque medicis inter omnia salis genera perhibetur. Omnis locus in quo reperitur sal, sterilis est, nihilque gignit: et in totum sponte nascens intra haec est."

The chief point to note in connexion with this extract is that Pliny, in the sentence commencing 'Similis est,' is unconsciously referring to an entirely different salt from that mentioned in the next sentence, which is probably taken from the *Materia Medica* of his contemporary Dioscorides (Book V, Sect. 126). The Egyptian salt, 'longis glebis,' is almost certainly a sodium carbonate ('Natron'), whereas the latter salt, 'rectis scissuris,' corresponds to common salt. The silence of Dioscorides and Pliny as to the volatility of the salt they describe also corroborates the view that the sal-ammoniac of the Greeks and Romans was not a salt of ammonia.[1]

Turning now to the consideration of its use in the current alchemy of the Alexandrian school, we find that although casually alluded to as a cleansing agent or flux,[2] sal-ammoniac finds no place in the lists of drugs that then entered into alchemical processes. This may be seen from the following comparative table of substances used for making gold and silver, which is drawn from the '*Treatise of Moses*' edited by Berthelot in the third volume of his *Collection des Anciens Alchimistes Grecs*.[3]

For Chrysopoïa.	For Argyropoïa.
Mercury (from Cinnabar)	'Mercury' drawn from
The metallic constituent[4] of Magnesia	(*a*) Arsenic[9]
Chrysocolla[5]	(*b*) Sandarach[9]
Claudianos[6]	(*c*) Psimmithion[10]
Yellow Arsenic	(*d*) Magnesia
Cadmia[7]	(*e*) Italian Stimmi[11]
Androdamas[8]	Copper

[1] This has been often pointed out before—first, I believe, by Beckmann in his *History of Inventions and Discoveries*, though I have not been able to refer to this book.

[2] *E.g.*, in the X Papyrus of Leyden. Cf. Berthelot, *Collection des Anciens Alchimistes Grecs*, I, Introd., pp. 30 and 45.

[3] Text, pp. 306 and 307; Trans., pp. 294 and 295. The '*Treatise of Moses*' does not furnish material for a complete table (*e.g.*, it does not mention Tin and Iron which are quoted from Democritos by Zosimos as entering into alchemical operations; cf. Berthelot, *op. cit.*, II, p. 159), but the lists now given are sufficient to show (*a*) that Alexandrian alchemy dealt chiefly with inorganic substances; and (*b*) that Mercury and Lead were the chief subjects of transmutation.

[4] Apparently an alloy of Lead and Copper, elsewhere called Μολυβδόχαλκός. One variety of Magnesia was probably therefore an impure lead sulphide; cf. Berthelot, *op. cit.*, I, Trans., p. 11; II, Trans., pp. 184-193.

[5] In the X Papyrus of Leyden, an alloy of Copper, Gold, Tin and other metals (Berthelot *op. cit.*, I, Introd., p. 36).

[6] According to Berthelot, (*op. cit.*, I, Introd., p. 244) this is an alloy of Copper and Lead.

[7] (*a*) An ore of copper; Pliny, *Hist. Nat.*, XXXIV, 2: (*b*) The volatilised deposit obtained in the metallurgy of silver (*Idem*, 22), and copper (Dioscorides, V, 84).

[8] Arsenical Pyrites; cf. Berthelot, *op. cit.*, I, Trans., p. 5.

[9] Arsenic = Orpiment, and Sandarach = Realgar; (Berthelot, *Collection des Anciens Alchimistes Grecs*, I, Introd., p. 238).

[10] Lead Acetate or Carbonate, cf. Pliny: "Fit autem ramentis plumbi tenuissimis super vas aceti asperrimi impositis, atque ita distillantibus. Quod ex eo cecidit in ipsum acetum, arefactum molitur, et cribratur, iterumque aceto mixto in pastillos dividitur, et in sole siccatur aestate." (*Hist. Nat.*, XXXIV, 54). According to Rossi (quoted by Liddell and Scott) the word is of Egyptian origin.

[11] Lead or Antimony Sulphide, (Berthelot, *op. cit.*, I, Trans., p. 11, note).

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For Chrysopoïa.	For Argyropoïa.
Alum	Lead
Sulphur[1]	Earth of Chios[11]
Pyrites	White Cadmia
Ochre of Attica[2]	Asteritis [11]
Sinopis of Pontus[3]	Earth of Cimolia[11]
Divine Water[4]	White Arsenic
Yellow Sōry[5]	Misy [5] (crude and roasted)
Yellow Chalcanthon[6]	White Litharge
Cinnabar	Psimmithion
Various 'Plants' and 'Flowers'[7]	Red Natron
Cyanos[8]	Salt of Cappadocia[12]
Gum of the Egyptian Acanthus	White Magnesia.
Vinegar	Aphroselinon[13] of Glass.
Urine[9]	Cyanos
Sea Water	Burnt Lime
Solutions of { Lime; Ashes of Cabbage; Cream of Tartar; Natron (νίτρον); Arsenic; Sulphur }	
Milk of an Ass [10]	
Milk of a Bitch[10]	

From the similarity of the contents of the '*Treatise of Moses*' to that of the alchemical Papyri of Leyden, we may conclude that this table represents an alchemist's equipment in Alexandria in the 3rd century A.D.; and as, moreover, little or no change in nomenclature

1 Θεῖον ἄπυρον ὃ ἐστιν ἄκαυστον, "Unburnt Sulphur which has been rendered incombustible." According to the 10th cent. Lexicon of the MS. of St. Marks, Venice, (Berthelot, *op. cit.*, I, p. 6), this is equivalent to saying "which has been whitened."

2 Perhaps Orpiment (Berthelot, *op. cit.*, I, Trans., p. 18).

3 Probably a natural Oxide of Iron; cf. Pliny, *Hist. Nat.*, XXXV, 13.

4 Solution of Calcium Polysulphide (Berthelot, *op. cit.*, I, Introd., p. 47).

5 Two varieties of Chalcitis, "lapis ex quo ipsum aes coquitur" (Pliny *Hist. Nat.*, XXXIV, 29, 30 and 31). Chalcitis, weathered into the form of alum called 'schiston' (*Idem*, XXXV, 52), from which it appears to be a sulphide or basic sulphate.

6 Greek 'Chalcanthon' = Latin 'Atramentum' = our 'Vitriol.' It seems to have generally contained some Copper Sulphate *e.g.*, Pliny, *op. cit.*, XXXIV, 22, "Color est caeruleus, perquam spectabili nitore, vitrumque esse creditur," and may therefore be assumed to be the decomposition product of copper pyrites.

7 These were probably symbolical names for mineral substances (Berthelot, *op. cit.*, II, Trans., p. 159, note).

8 Pliny (*Hist. Nat.*, XXXVII, 38) mentions a blue gem called Cyanos, but in the present case some salt of copper may be meant.

9 Both ordinary, and that of a boy—οὖρον ἀφθόριον.

10 Symbolical names for sulphur (?); cf. Berthelot, *op. cit.*, I, Trans., p. 6. In the 10th century Syriac Dictionary of Bar Bahlūl, the milk of a bitch is, however, a synonym for Iron Filings (!); cf. Berthelot, *La Chimie au Moyen Âge*, II, p. 130.

11 Various kinds of clay, of which Earth of Cimolia was probably Kaolin. Asteritis has been taken as equivalent to Earth of Samos; cf. Pliny, *Hist. Nat.*, XXXV, 53, 56 and 57.

12 Common salt; cf. Berthelot, *op. cit.*, I, Introd., p. 266.

13 Aphroselinon corresponds to either Selenite, Mica, or Talc (Berthelot, *op. cit.*, I, Introd., p. 267).

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is found in the alchemical writings of Stephanos and other Greek commentators of the 6th and 7th centuries, the table may be taken as fairly typical of the alchemical ideas that prevailed in Egypt down to the time of the Arab invasion.

Arabic alchemy was chiefly drawn from Greek sources, but the most casual examination of the work of any alchemical author during the first five centuries from the *Hijra*, will convince the student of the great influence that was brought to bear on the Greek theories by Asiatic thought. The most striking result was the re-establishment of a belief in the essential connexion between animals, plants, and minerals, and a consequent revival of faith in the efficacy of of organic materials in alchemical research.

A quotation from Al-Khwārazmī's *Mafātīḥu-l-'Ulūm*, written about 976 A.D., will serve to make this clear.

"Al-Ḥajar ('The Stone'). Among the alchemists this is anything by which the Art can be performed, that is, anything out of which Elixir can be made. These substances are of two kinds, Animal, and Mineral. The best of these are the Animal.

"The latter are Hair, Blood, Urine, Eggs, Gall, Brains, Skulls, Shells, and Horns. The best of these is Human Hair, and next Eggs.

"The varieties of Mineral 'Stones' are (*a*) among the 'Bodies,' Gold, Silver, Lead, and Tin; (*b*) among the 'Spirits,' Mercury, Arsenic Sulphide, Sulphur, and *Nūshādur*."[1]

We see from this definition that *Nūshādur*, the substance whose name the Latin translators from Arabic of the 11th and subsequent centuries metamorphosed into Sal-Ammoniac,[2] had taken rank among the most important chemicals in Arabic alchemy, and our first duty therefore is to ascertain what was the special value of *Nūshādur* that caused it to be held in such high esteem.

Regarding this point, ample information exists in alchemical literature. The statements that will now be given are selected not only because they suggest a possible explanation for its use, but also for the reason that they afford clear indications as to its chemical constitution.

In the *Mafātīḥu-l-'Ulūm* the following is found: "Another of their substances is *Nūshādur*, and it is of two kinds (*a*) Mineral; and (*b*) Artificial, made from Hair."[3]

A second method of preparing it is given in the 13th cent. Latin treatise '*De Investigatione Perfectionis*,' that purports to be a translation of a work of Jābir, the 'Father of Arabian Alchemy,' who died in 776 A.D.

"*De Salis armoniaci præparatione.* Sal-armoniacus fit ex quinque partibus [vel duabus] urinæ humanæ et parte una sudoris ejusdem, et parte una salis communis, et parte una cum dimidia fuliginis lignorum, vel baculorum habitis simul coctis usque ad

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1 Van Vloten's ed., Leyden, 1895, p. 265. For the definition of 'Bodies' and 'Spirits' cf. *Idem*, p. 259—"Bodies are so called because they remain inert and fixed; while Spirits owe their name to the fact that they fly away when heated."

2 Or 'Armoniac.' "Debes habere de quatuor spiritibus, scilicet aurum vivum, sulphur, auripigmentum, sal-armoniacum," (*De Anima* of the pseudo-Avicenna, 1572 Basle ed., p. 96). This book was probably compiled in Spain 150 or 200 years after the death of Ibn Sīnā (Avicenna).

3 *Ed. cit.*, p. 259. When hair is subjected to destructive distillation below a red heat, white crystals of Ammonium Carbonate collect on the walls of the receiver. Sulphuretted hydrogen is also evolved. Practically no ammonium chloride is volatilised, but halogen can be detected in the residue.

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consumptionem humiditatis ;[1] sublima salem armoniacum verum et utilem, hunc iterum in sudore dissolve, et congela, et sublima à sale communi semel; et est præparatus. Vel teratur primò cum præparatione Salis communis mundati, postea sublimetur in alto alutel, donec totaliter fuerit extractum purum: postea solvatur super porphydum[2] sub divo, si de ejus aqua habetur facere, vel servetur ipsum sublimatum et purum sufficienter."[3]

The famous Spanish botanist Ibnu-l-Baiṭār in his *Jāmī'u-l-Mufradāt* (Treatise on Simples) quotes the following remarks of three of his predecessors :—

"Ibnu-t-Tilmīḏh.[4] Il y en a deux espèces, un sel naturel et un sel artificiel. Le sel naturel sort de sources chaudes dans les montagnes du Khorassan,[5] que l'on dit avoir un bouillonnement très-intense. Le meilleur est le naturel . . . qui est clair comme du cristal.—El-Ghafeky.[6] C'est une espèce de sel . . . Il s'en trouve de fortement salé qui pique fortement la langue. Il y en a aussi qui provient de la suie des bains, surtout des bains chauffés au fumier.[7] . . . Il est utile contre les taies de l'œil. Il combat la procidence de la luette sur la gorge et convient contre les angines . . . Dissous dans de l'eau et versé dans une habitation, il en écarte les reptiles; versé dans leur repaire, il les tue.[8] Trituré avec de l'eau de rue et ingurgité, il tue les sangsues. Le Chérif El-Edrissy.[9] Préparé avec de l'huile et employé en frictions au bain sur la gale de nature atrabilaire, il la fait disparaître. Mâché et projeté dans la bouche des serpents et des vipères, il les tue subitement. Mélangé avec de l'huile d'œufs et employé en onctions sur la lèpre blanche, après des lotions préalables, il la guérit, surtout si l'on en prolonge l'usage."[10]

From these statements two inferences may be drawn. One is that the *Nūsẖādur* of the Arabs included both Ammonium Chloride and Ammonium Carbonate; the other that the introduction of *Nūsẖādur* into alchemy, was, in all probability, due to its supposed magical character—a character which, as I shall now proceed to show, would undoubtedly be assigned to it by Asiatics from its intimate connexion with animal substances. Regarding the first point, no further explanation is necessary than the notes that have

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[1] Text 'hujusmodi'; corrected from p. 715 of the *Artis Chemicae Principes;* cf. Note (3) *infra*.

[2] Probably 'porphyrum,' the sense being that the sublimed sal-ammoniac is allowed to deliquesce in a porphyry vessel.

[3] This article occurs on p. 480 of the 16th cent. volume entitled *Artis Chemicae Principes*, the first part of which is occupied by the *De Anima* of the pseudo-Avicenna (cf. note 2, p. 28 *antea*). A portion of the same article is also found in another treatise attributed to Jābir, *viz.*, the '*De Inventione Veritatis*,' reprinted on pp. 709-735 of the Basle volume. By the process described, Ammonium Chloride would be obtained.

[4] Celebrated doctor of Baghdād, 1073—1164 A.D.

[5] Burnes (*Travels into Bukhara*, 1834 ed., II, p. 166) mentions that it is still obtained from the hills near Juzzak (Jazākh), a town to the N.E. of Samarcand in Khurāsān. As it is of volcanic origin, this salt is probably ammonium chloride, but I have not been able to discover where the analysis of it that Klaproth is reported to have made was published.

[6] Spanish botanist, † 1164.

[7] The soot of dung fires always contains an appreciable quantity of ammonium chloride. This was undoubtedly the chemical constitution of the sal-ammoniac of mediaeval Europe, as even down to the 17th century the sal-ammoniac of European commerce was almost entirely drawn from Egypt, where it was manufactured from the soot of the camel-dung fires of the fellahin. (cf. Ure's *Dictionary of Arts, Manufactures and Mines*, 7th ed, Vol. I, p. 149).

[8] In the Syrio-Arabic alchemical MS. of the British Museum (cf. Berthelot, *La Chimie au Moyen Âge*, II, p. 160) it is stated that it was for this reason that the symbolical name 'Theriac' was given to *Nūsẖādur*. This famous medicine of Galen was supposed to be very efficacious against snake-bite. Cf. also this paper, p. 37 note (1).

[9] Ash-Sharīf al-Idrīsī, better known as a geographer. His chief work, *Nuzhatu-l-Mushtāq*, was finished in 1154 A.D.

[10] Leclerc's translation, Paris, 1877, Tome III, p. 380.

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already been given. In dealing with the second, I propose, for the sake of clearness, to confine myself almost entirely to a discussion of such beliefs in the magical properties of Hair, as may reasonably be supposed to have been current among Muhammadans of Arabic and Persian descent during the first five centuries from the *Hijra*.[1]

All magical rites spring from one source—the Pan-Animism of primitive races. To the savage it is almost impossible to conceive of matter devoid of the Immaterial; and when a body happens to be tenanted by a living soul, primitive man, with world-wide unanimity, agrees in extending the indwelling of the spirit to even such separable portions of the body as blood, hair, teeth and natural secretions. An evident corollary to the same idea is that "things which have once been conjoined must remain ever afterwards, even when quite dissevered from each other, in such a sympathetic relation that whatever is done to the one must similarly affect the other,"[2] and from this it is but a step to the practice of those magical rites by which men of all ages have striven to win control over another's will or life.

A familiar example among Semitic races of a belief in the connexion of a man's spirit with his hair is the story of Samson and Delilah, but in order to afford a clearer insight into the meaning of such beliefs, it may not be altogether inappropriate to illustrate what I have just stated by a detailed description of two ceremonial observances of the Muhammadans of modern India.

I will first deal with the methods of Exorcism that are employed by Muhammadans in the Madras Presidency.

When a devil enters into a man, his relatives prevent it from escaping prematurely by tying a knot in the demoniac's hair, and an exorcist [*'āmil* عامل] is summoned to expel the evil being with due ceremony. The exorcist begins by ascertaining the name of the demon, its place of origin, and the duration of its stay in the patient's body. Sometimes this information is obtained without any trouble, but if the devil is obstinate, it can be forced to speak by flogging the demoniac with a rattan over which an incantation has been read. The evil spirit is afterwards appeased by being asked what kind of food it would like as an offering on the day of its departure.

On the appointed day the exorcist enquires of the devil the exact spot at which it intends to leave the patient, and having obtained the necessary information, he follows the demoniac about wherever he goes, holding on by his hair either at the back or on one side of the head. "Wherever he may fall down, there he must let him lie; and having read the incantation, or the *aet-ool-koorsee*,[3] over an iron nail or wooden peg, he is to strike it into the ground.[4] The moment the demoniac falls down, the exorcist instantly plucks out one

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1 It should, however, be understood that similar arguments may also be used in connexion with most, if not all, other organic products.

2 Frazer, *The Golden Bough*, 2nd ed., I, p. 49.

3 آيةُ الكرسي (*Āyatu-l-Kursi*, 'the Verse of the Throne'), Verse 256 of the second Chapter of the Qur'ān.

4 The account is somewhat confused, but the use of the nail is apparently to peg the devil down, and so prevent him from escaping while being transferred from the demoniac to the bottle.

Similar ideas were current in Europe during the time of Pliny, *e.g.*, a man could be injured by hammering a nail into an image, or drawing, "Defigi quidem diris deprecationibus nemo non metuit" (*Hist. Nat.*, XXVIII, 4); while epilepsy could be cured

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or two hairs from among those which he holds in his hand, and reading some established spell over them, puts them into a bottle and corks it up; whereupon the patient's devil is supposed to be imprisoned therein. Then he either buries the bottle underground or burns it; after which the devil never returns.

"Some *Seannas*[1] make a small wax doll, fasten one extremity of a hair to the crown of its head, and the other to the bottom of a cork, fill the bottle with smoke, put the doll into it, and cork it up. They put in smoke to prevent people distinguishing the doll, which remains suspended in the middle of the bottle. The *Seanna*, the moment the demoniac falls on the ground, pulls out a hair or two as above stated, and contrives to insert them into the bottle; which, holding up to public view, he exclaims, "Behold! I have cast the devil out of the demoniac and confined him in this bottle. There he is, standing in the middle of it, longing to come out. Now, if you give me so much money, well and good; if not, I will let him loose again." Those foolish people, on beholding the doll in the bottle, actually believe it to be the devil himself, and out of fear give him any sum of money he asks, and get it buried or burnt."[2]

The story just given is chiefly noticeable for the light that it throws on the path by which men passed from a belief in the innate spirituality of hair to the utilisation of the same or any other adjunct of the human body in operations that were designed with the intention of bringing one man into another's power. The procedure only varied in detail. "A drop of a man's blood, some clippings of his hair or parings of his nails, a rag of the garment which he had worn, sufficed to give a sorcerer complete power over him. These relics of his person the magician kneaded into a lump of wax, which he moulded into the likeness and dressed after the fashion of his intended victim, who was then at the mercy of his tormentor. If the image was exposed to the fire, the person whom it represented

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by hammering an iron nail into the place where the head of the patient had lain, "Clavum ferreum defigere, in quo loco primum caput defixerit corruens morbo comitiali, absolutorium ejus mali dicitur" (*op. cit.*, XXVIII, 17).

[1] سیانا, *Siyānā*, an Urdu word literally meaning 'cunning,' or 'artful.' Herklots translates it by 'conjuror.'

[2] *Qanoon-e-Islam* by Jaffur Shurreef (Ja'far Sharīf of Ellore), Herklot's translation, 1863 ed., pp. 220-222. Ja'far Sharīf mentions with approbation at the beginning of his chapter on Exorcism the *Jawāhir-i-Khamsa*, written in 956 A.H. (= 1549 A.D.), by Muḥammad Ghauth Gwāliyārī, who was a descendant of the famous Persian Ṣūfī Farīdu-d-dīn 'Aṭṭār († 1230 A.D.) An examination of a MS. copy of the *Jawāhir-i-Khamsa* that is in the library of the Asiatic Society of Bengal does not, however, lend any support to the suggestion that Ja'far Sharīf derived most of his information from this book, and the account quoted in the text may, therefore, be accepted as an independent description of the methods that were current in Madras when the *Qanoon-e-Islam* was written, 75 years ago.

In Bengal (Calcutta), the methods employed are of a much simpler character. The *'āmil* himself ties the knot in the demoniac's hair when he first sees him, and he is generally content if the devil is simply driven away by his exorcisms. The bottling process is only performed if the spirit persists in returning. The patient's hair does not seem to be used as a medium for transferring the spirit to the bottle, nor is the spirit pegged down during the operation. Iron pegs are, however, employed by Bengali Muhammadans to safeguard a house against the advent of evil spirits. A house may be protected either by the insertion of one nail on each side of the threshhold, or by placing one in each of the four corners of the house. Suitable extracts from the Qur'ān are read while this is being done.

In the case of patients whom the *'āmil* is not allowed to see, such as women, he writes an incantation on a piece of paper, and directs that it should be bound round a stick by many strands of cotton. This torch (پلیتہ, *palītah*—or *falītah*), after being dipped in *ghī*, is taken to the patient's room and lighted. If the patient can be induced to stare at it, the evil spirit will depart with the rising smoke. A much fuller account of the same process, accompanied by illustrations of the prescribed charms, is to be found in the *Qanoon-e-Islam*, pp. 223 and 224.

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straightway fell into a burning fever; if it were stabbed with a knife, he felt the pain of the wound."[1] Such was a typical form of the enchantment.

These and similar rites were only too familiar to the inhabitants of Western Asia in pre-Islāmic times;[2] they survive in the East to the present day; and one effect on popular imagination is seen in the care that is still displayed even amongst civilised races in the disposal of shorn hair. An excellent illustration of this is the peculiar ceremony called '*Aqīqah*[3] (عقيقة) that is observed in every Muhammadan household soon after a child's birth.

Amongst Bengali Sunnis of good family, the '*Aqīqah* ceremony is generally performed on the seventh day after birth.[4] Instances are also known of the fortieth day being chosen, but this variation is probably due to the fact that the fortieth day marks the end of the mother's ceremonial impurity. As this is always celebrated by another festival called *Chilla* (چلہ) a combination of the two ceremonies is obviously useful in reducing the necessary expenditure to a minimum.

Early in the morning on the day selected, the members of the family assemble, and in their presence the family barber completely shaves the child's head. The shorn hair[5] is carefully weighed against an equal weight of gold and silver[6] and then wrapped up with the latter in a *pān*-leaf.

Meantime a sacrifice has been got ready. This consists of two goats (or sheep)[7] in the

[1] The ancient Egyptian procedure (Maspero, *apud* Frazer, *Golden Bough*, I, p. 15.).

[2] *E.g.* Frazer, *op.cit.*, I, p. 377.

[3] From '*Aqqa* (عقّ) to cut, referring either to the child's hair or to the animal's throat. The '*Aqīqah* is not mentioned in the Qur'ān, but is connected with pre-Islāmic times by reliable tradition. Thus Ibn 'Ābidīn gives on the authority of Abū Da'ūd († 888 A.D.) the following statement of Buraydah, one of the Companions of the Prophet, "We used, in the time of ignorance, when children were born to us, to slay sheep and rub the child's head with the blood; but when Islām came, we sacrificed a sheep on the seventh day, and shaved the child's head and rubbed saffron on it." Qutādah, another Companion (quoted by Majdu-d-dīn al-Fīrūzābādī), corroborates this by his statement that until the practice was forbidden by Muḥammad, a handful of the goat's hair used to be dipped in the blood and smeared over the boy's hair before his head was shaved.

The use of saffron seems to have died out in Bengal, but Ja'far Sharīf states that it is customary in Southern India—presumably in the neighbourhood of his native-place, Ellore. The saffron, however, is there applied to the child's head after the barber has done his work. The practice of the Muhammadan Malays, who probably drew their religious beliefs from Southern India, is much nearer the original, as when they perform the '*Aqīqah*, a red lather is rubbed over the child's head before shaving off the hair (Skeat, *Malay Magic*, p. 341).

[Dr. Annandale, who has visited the extreme S.E. corner of India—Ramnad in the Madura district—since this paper was written, informs me, on the other hand, that the ignorant Muhammadan sect of 'Lubbais' of that part of India only use oil, or a mixture of oil and sandalwood. This is rubbed on after the boy's head has been shaved. Ja'far Sharīf also notes this substitution of sandalwood for saffron, as customary amongst people who cannot afford the more expensive saffron.—Sept. 20th, 1905.]

[4] Ibn 'Ābidīn states that Muḥammad performed the ceremony on himself after becoming a Prophet, but, subsequently, when his grandchildren Ḥasan and Ḥusain were born to Fāṭimah and 'Ali, he used the seventh day after birth for its observance. Traditionists, however, agree that '*Aqīqah* can be lawfully performed at any time up to the age of puberty. Robertson Smith (*Religion of the Semites*, p. 330), is of the opinion that the '*Aqīqah* was originally a ceremony of initiation into manhood, and that the transference of the ceremony to infancy was a later innovation.

[5] So far as I can ascertain, no analogous practice exists amongst Bengali Mussalmans with regard to the first parings of a child's nails. They are simply thrown away.

[6] A few filings of gold and a two-anna piece. According to the Imām Muḥammad Ash-Shaybānī († 804 A.D. He was a pupil of the jurisconsult Abū Ḥanīfa, who died in 767 A.D.), the hair of Ḥasan and Ḥusain was weighed against silver, which was then given to the poor. The traditionists Mālik († 795 A.D.) and Shāfi'ī († 820 A.D.) state, on the other hand, that it is preferable to weigh the hair against both silver and gold (Majdu-d-dīn al-Fīrūzābādī).

[7] Females or geldings; not, as Ja'far Sharīf states, males.

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case of a boy, and one in the case of a girl.[1] The animals' throats are cut by the principal member of the family, who says as he does so, '*Bismillah Allāhu akbar*,'[2] and after the carcases have been skinned and disembowelled by a butcher, the flesh is carefully removed from the bones and divided into two portions. The larger part of the uncooked meat is distributed among the friends of the family. The remainder[3] is kept and cooked for the evening meal; but of this meat neither the father nor mother of the child may partake.

The skins of the slaughtered animals are invaribly sold, and the proceeds given to the poor. The offal and hoofs are thrown away. The bones—which must on no account have been broken, as that would be of ill-omen for the child—are usually buried with the *pān*-leaf containing the hair and precious metals in any convenient waste piece of ground.[4] Some Calcutta Muhammadans, however, are in the habit of burying their son's hair in a hole dug in the ground within the precincts of either the Law Courts, the Legislative Department, or a mosque. In the two former cases, the idea is that this procedure will ensure worldly success to the boy in after-life, while if the hair is deposited in the compound of a mosque [5] it is believed that the bent of the child's mind will be towards religion.[6]

The first of the practices that have just been described recalls to our recollection the

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[1] Robertson Smith states (*Kinship and Marriage*, pp. 180-182,) that according to the earliest traditions, the *'Aqīqah* was only performed in ancient Arab times for boys, but it is obvious from the commentary of Ibn Ḥajar, that there was great difference of opinion on this point. Ibn Ḥajar quotes Abū Hurairah, one of the Companions, to the effect that in the time of the Prophet only Jews omitted to perform the *'Aqīqah* ceremony for their daughters. [The Lubbais—see note (3) p. 32, *antea*—still only perform the ceremony on boys of 2 or 3 years old.]

[2] Ibn 'Ābidīn says that the following prayer should be offered by the child's guardian, whilst the animals are being slain. "O God, this is the *'Aqīqah* for my child, blood of the *'Aqīqah* for his blood, flesh for his flesh, bone for his bone, skin for his skin and hair for his hair. O God, may it serve as a ransom of my son from hell!"

[3] The Prophet ordered that one leg should be given to the midwife, but in modern Calcutta, where all the midwives are Hindus, this injunction naturally cannot be observed. Instead, the midwife receives some dhāl and rice, with a gift of money.

[4] The burying of the *'Aqīqah* hair does not seem to be authorised by Muhammadan tradition, and might therefore be regarded as being of Indian origin (cf. Oldenberg, *Sāṅkhāyana Gṛihya Sūtra*, (Sacred Books of the East, Vol. XXIX, p. 57). A similar practice, however,—the recognition of which can be traced back to the early centuries of Islām—is seen in the burying of the pilgrims' hair at Mina Bazaar, near Mecca, when the 'Haj' is complete (cf. Burton's *Pilgrimage to El Medinah and Makkah*, Vol. III, p. 285, note). In Southern India (cf. *Qanoon-e-Islam*, p. 21) the hair, instead of being offered to the earth, is consigned to the water, a practice which may be regarded as analogous to the Thursday evening offerings of the more ignorant Bengali Muhammadans to Al-Khiḍhr ('The Green One'), the deathless being who is supposed to be alluded to the Sūrah XXVIII of the Qur'ān, and who is believed to look after the well-being of devout Mussalmans. It is popularly believed that he resides in the waters of tanks and rivers and, to propitiate him, lamps are lighted every Thursday at dusk on the sides of tanks, while offerings of food are floated away on pieces of plantain leaf.

The impossible and—to orthodox Muhammadans of the present day—scandalous Malay idea of endeavouring to get the shorn hair thrown into the sacred well of Zamzam at Mecca (Skeat, *Malay Magic*, p. 342), may either be a survival of the practice of Southern India, or an imitation of the Siamese custom described by Young (*Kingdom of the Yellow Robe*, p. 79). It is hardly likely to go back to the times when offerings were actually made to Zamzam and other sacred weils in Arabia (cf. Robertson Smith, *Religion of the Semites*, pp. 168 and 177).

[5] Similar examples of the dedication of hair at shrines by the ancient Arabs are given by Robertson Smith, (*op. cit.*, p. 331). [The Lubbais—see note (3) p. 32, *antea*—also bury the *'Aqīqah* hair near a mosque].

[6] The references to traditional authorities that I have been able, through the assistance of Maulawī Hidāyat Ḥusain, to add to the foregoing account, are chiefly drawn from (*a*) the *Fatḥu-l-Bārī fi Sharḥi-l-Bukhārī* of Ibn Ḥajar al-'Asqalānī († 1449 A.D.). This is a commentary on the *Jāmi'u-ṣ-Ṣaḥīḥ* of the celebrated traditionist Al-Bukhārī († 870 A.D.); (*b*) *the Sifru-s-Sa'ādah* of Majdu-d-dīn al-Fīrūzābādī († 1414 A.D.); (*c*) the *Baḥru-r-Rā'iq* of Ibn Nujaim († 1562 A.D.). This is a commentary on the *Kanzu-d-Daqā'iq* of Ḥāfiḍhu-d-dīn an-Nasafī († 1310 A.D.); (*d*) Ibn 'Ābidīn's abridgment of the *Fatāwī al-Ḥāmidīyya* of Sa'dī Efendī Ḥāmid al-Qonāwī († 1577 A.D.). Ibn 'Ābidīn, who is much esteemed in India as a jurisconsult, died in 1836.

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fact that medical science in its origin was based upon a belief in the theory that all disease originated from demoniacal possession ;[1] the second affords an excellent example of the belief in the permanence of the spiritual connexion between mankind and their shorn locks ; while considered together they offer the further suggestion that if we were in a position to prove that the Arabs utilised human hair in combatting disease, we would, *ipso facto*, be provided with valuable evidence towards establishing the magical origin of the use of sal-ammoniac. This proof is readily obtained from the pages of Ibnu-l-Baiṭār. As usual he cites earlier authorities.

" Razès dans le *Continent*.[2] Athour Sophos dit que les cheveux de l'homme, trempés dans du vinaigre et appliqués sur la morsure d'un chien enragé, la guérissent à l'instant. Trempés dans du vin pur et de l'huile et appliqués sur une plaie de la tête, ils l'empêchent de s'enflammer. Les vapeurs des cheveux brûlés, respirées, combattent l'hystérie et les écoulements utérins. Les cheveux brûlés, triturés avec du vinaigre, sont appliqués utilement sur les pustules. Triturés avec du miel et employés en embrocations sur les aphthes chez les enfants, ils obtiennent un succès prononcé. Si on les triture avec de l'encens qu'on en répande sur les plaies de la tête après avoir fait des onctions avec de la poix, ou bien si on les bat avec du miel et qu'on les applique sur ces plaies, on les guérit. Si l'on triture des cheveux brûlés avec de la litharge et qu'on en fasse des frictions sur la gale et les démangeaisons de l'œil, on les fait passer.[3] Les cheveux brûlés, triturés avec du beurre de brebis et employés en frictions sur les ecchymoses et les tumeurs causées par les mouches, sont un remède sûr. Mélangés avec de l'huile de roses et injectés dans l'oreille, ils en guérissent les douleurs . . . . . Propriétés d' Ibn Zohr.[4] Les cheveux d'un jeune enfant, avant qu'ils aient acquis de la consistance, portés par un individu goutteux ou piqué par un scorpion, le soulagent et lui enlèvent sa

1 An example in the past is that of the ancient Egyptians. "The illnesses to which the human race is prone . . . . were all attributed to the presence of an invisible being, whether spectre or demon, who by some supernatural means had been made to enter the patient, or who, unbidden, had by malice or necessity taken up his abode within him" (Maspero, *Dawn of Civilisation*, p. 215).

A survival of the belief to the present day is shown by the following statement regarding the Patāni Malays. "A Jalor midwife said that every person had one hundred and ninety spirits in him, each of which was the cause of some particular disease, and each of which, if it gained the mastery over the rest, could bring about the disease it represented" (Annandale, *Fasciculi Malayenses*, Anthropology, Part II (*a*) p. 37).

2 The *Hāwī* of Abū Bakr ibn Zakarīyā ar-Rāzī, the celebrated doctor, † 923 or 932 A.D. The suggestion conveyed by the name of the authority first mentioned that Ar-Rāzī is quoting from some Greek author, is confirmed by the fact that most of the information is also to be found in Pliny. See next Note.

3 Compare with the foregoing, "Virorum quoque capillus, canis morsibus medetur ex aceto : et capitum vulneribus ex oleo aut vino. . . . . Combustus æque capillus, carcinomati" (Pliny, *Hist. Nat.*, XXVIII, 9). " Quae ex mulierum corporibus traduntur ad portentorum miracula accedunt. . . . . Capilli si crementur, odore serpentes fugari. Eodem odore vulvæ morbo strangulatas respirare. Cinere eo quidem, si in testa sint cremati, vel cum spuma argenti, scabritias oculorum ac prurigines emendari : item verrucas ('warts'), et infantium hulcera cum melle. Capitis quoque vulnera, et omnium hulcerum sinus, addito melle ac thure" (Pliny, *op. cit.*, XXVIII, 20).

The following may also serve to recall two other sources of sal-ammoniac: "Æschines Atheniensis excrementorum cinere anginis medebatur, et tonsilis, uvisque et carcinomatis. Hoc medicamentum vocabat botryon" (*op. cit.*, XXVIII, 10.): and (speaking of the Ophiogenes of Cyprus, whose saliva was said to cure snake-bite) " Atque eorum sudor quoque medebatur, non modo saliva" (*op. cit.*, XXVIII, 6).

4 Abu'l 'Alā' Zuhr ibn 'Abdi-l-Malik ibn Zuhr, who died at Seville in 1131 A.D. He was the father of 'Avenzoar' of the Latins.

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souffrance.[1] Les fumigations faites avec les cheveux de l'homme jaunissent les objects qu'elles atteignent. L'eau distillée qu'on en obtient, employée en frictions, fait pousser les cheveux."[2]

In practically all the cases just quoted, the cure may be regarded as the victory of the human personality in the hair over the spirits of disease, and this being so, a similar explanation necessarily follows for the medicinal uses of the sal-ammoniac into which hair passes when it is heated. The smell, and volatility of the salt offer further associations of a magical character; and we begin, therefore, to understand the reasons that finally led to the classification of sal-ammoniac as one of the 'Spirits' of the Art.

Another manifestation of a belief in the spirituality of hair and other animal substances is a proneness to expect the re-appearance of the spirit in some living form. In early Islām, such an idea would be familiar to Muhammadans of Persian descent from the statement of the Avesta[3] that children's hair and nails, if not buried with suitable rites, turn into lice, while the following extracts will illustrate to what lengths the theory had extended four or five centuries later.

The first is taken from the translation by M. R. Duval of a Syrio-Arabic MS. in the British Museum, which probably dates from the 10th or 11th century A.D.

"Nous pouvons faire qu'un végétal devienne animal, et qu'un animal produise un autre animal. Soit par exemple les cheveux. Quand les cheveux humains pourrissent, après un certain temps il se forme un serpent vivant. De même, la chair de boeuf se change en abeilles et en frelons; l'œuf devient dragon; le corbeau engendre les mouches. Bien des choses, en pourrissant et en s'altérant, engendrent des espèces d'animaux. De la pourriture des plantes naissent certains animaux. Quant au basilic, en pourrissant, il engendre des scorpions venimeux. De même un grand nombre de plantes en pourrissant et en s'altérant, produisent des animaux."[4]

The second is a passage from Tughra'i, an alchemist who died in 1121 A.D.,[5] cited by Ibn Khaldūn in his '*Prolegomena*' (De Slane's translation).[6]

"Nous avons plusieurs fois vu comment on peut créer des animaux sans en connaître les differences spécifiques;[7] avec de la terre et de la paille on peut faire naître des scorpions, et avec des crins on peut former des serpents. Citons encore l'exemple (de production artificielle) mentionné par les auteurs qui ont traité de l'agriculture: quand les abeilles viennent à manquer, on peut en extraire un essaim du cadavre d'un veau. Mentionnons aussi la manière de produire des roseaux (en plantant) des cornes d'animaux ongulés, et comment on obtient des cannes à sucre en remplissant ces cornes avec du miel avant de les planter."

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1 For boys' hair as a cure for gout, cf. also Pliny, *op. cit.*, XXVIII, 9.

2 Ibnu-l-Baiṭār, Leclerc's translation, Tome II, pp. 334 and 335.

3 Darmesteter's translation of the *Vendīdād* (Vol. IV.—Sacred Books of the East), pp. 186-188.

4 Berthelot, *La Chimie au Moyen Âge*, II, p. 155.

5 Better known for his *Lāmīyatu-l-'Ajam*, a lament on the misfortunes of his times. This was translated into Latin verse by Pococke, the first Laudian Professor of Arabic at Oxford.

6 III, p. 255.

7 *I.e.*, the differences that separate one group of animals from another.

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The important point of these quotations is that they are the actual arguments employed by alchemists in upholding the possibility of the conversion of base metals into silver and gold. Both are taken from alchemical works, and in Tughra'i's treatise, the author at once follows up his statements by the remark "If then such changes can be brought about by artificial means, what is to prevent similar transmutations among the metals?"

The argument must indeed have seemed an almost unanswerable one to Muhammadans of those times, for the transmutation of dead and living matter is a dogma founded upon popular observation, while its strength is sufficiently shown by the fact that it gains a certain amount of credence in European countries even at the present day.[1] As Maspero has pointed out, such ideas are likely to have been fostered in the early ages of Islām by the belief of the Egyptians that their gods, after death, were changed into gold, silver, and lapis lazuli;[2] but in all probability, a far more potent influence was the belief that existed throughout Muhammadan times in the essential unity of the world of nature. No strict line of demarcation separated plants and minerals from animals and man; all were looked upon as closely related units of a single whole.

In accordance with this belief we find Arabic alchemy based upon the principle that minerals consist of Body, Soul and Spirit.[3] By an obvious deduction it follows, that as the products of the Art, *i.e.*, gold and silver, resemble a human body,[4] their difference from the baser metals may possibly be ascribed to their healthier condition. In other words, the base metals must be suffering from diseases, and these diseases it is the business of alchemy to cure.

One of the clearest expositions of this doctrine that is to be found in alchemical literature, occurs in the *Pretiosa Margarita Novella*, written at Pola, in Istria, by one Petrus Bonus, 'Ferrariensis Physicus subtilis,' in the year 1330. Though the writer was a European, he is evidently drawing on Arabic authorities for his material.

The extract is made from a chapter bearing the rubric, 'In quo ostendit, quid sit Theriaca et venenum in lapide Philosophorum, secundum antiquos Philosophos.'

"Sic et hic lapis efficit in metallis leprosis, et ideo quandoque venenum, quandoque Theriaca dicitur. Metalla enim corrupta, quæ sunt quatuor,[5] laborant speciebus lepræ quatuor, ex aliquo quatuor humorum[6] corruptorum, et sanatur per dictum lapidem, sicut

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1 A case in point is the English and American belief mentioned by Dr. Annandale in a recent number of the *Journal of the Asiatic Society of Bengal* (Vol. LXXIII, Part III, No. 4, 1904) that Hair—Worms represent a stage in the development of a horse-hair into an eel or snake. From the quotations just given, it seems possible that the idea may have been introduced into Europe by the Arabs.

2 *Dawn of Civilisation*, p. 110.

3 Ibn Khaldūn, *trans. cit.*, III, p. 220.

4 Ibn Khaldūn, *trans. cit.*, III, p. 212. Both this, and the previous statement are quoted from a treatise of a pupil of the Spanish alchemist Maslama al-Majrīṭī, who died in 1007 A.D.

5 Iron, Copper, Tin and Lead. Bonus subsequently explains that silver is also corrupt, but that it differs from the other four metals in containing a 'theriac,' which enables it to purify itself and become gold in the presence of 'the Stone.'

6 The four humours were Black Bile, Yellow Bile, Phlegm, and Blood.

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lepræ hominum per serpentes àppropriatos.[1] . . . Aurum autem purissimum est, et nobilissimum, et æqualissimum, sicut sol inter sidera, et sicut sanguis purissimus in corpore humano temperatæ complexionis, carens omni extranea qualitate, et habens sanitatem summam. Et ideo ars sequens naturam, vult omnia cum hoc lapide sanare, [et est Theriaca et venenum], et in solum aurum transmutare, sicut facit natura. . . . Et Hali in suis Secretis: Hoc est sulphur rubeum, luminosum in tenebris: et est hyacinthus rubeus, et toxicum igneum, et interficiens et Leo victor, et malefactor, et ensis scindens, et Theriaca sanans omnem infirmitatem, etc. . . . Et Haly: Hic lapis est vita mortuorum et eorum refectio: est etiam medicina, conservans corpus et purgans, etc. . . . Et Morienus: Est autem elixir medicina ex pluribus confecta, quæ quidem medicina infirmitates metallorum sanat, quemadmodum Theriaca infirmitates hominum. Unde à quibusdam venenum appelari solet: quia sicut venenum in corpore humano, ita elixir in corpore metallino, etc."[2]

If we recall for a moment the belief of the early Muhammadans in the medicinal potency of hair, we cannot but acknowledge that such views on the constitution of matter made it inevitable that hair should be regarded by Arabic alchemists as one of the most valuable of drugs. This we have already seen to be the case, and all that we further need to emphasise, is the fact that when hair passed from medicine to alchemy, its virtues were still ascribed to magical association with the human body. On this point, the 13th century alchemical treatise *De Anima* supplies us with ample evidence.

"Dixit Abuali: Et loquar in hoc capitulo de capillis. Natura illorum frigida et sicca, et intrant in hoc magisterio. Si quis dividat eos per 4. partes,[3] aqua illorum indurat mercurium. Capilli sunt in multis modis, de homine grandi, de homine parvo, de mediocri, de bestiis, sed de bestiis non intrant in hoc magisterio, et sunt ibi de pilis hominum, et sunt de colera nigra, de colera citrina, et de flegmate, et de sanguine: et capilli qui intrant in magisterio ad habendum lapidem, sunt de juvenibus de XIII annis,[4] qui sunt de

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1 The snake was always associated with Æsculapius in classical times, while the same idea is seen in the belief of the ancient Arabs that medicinal waters were inhabited by *Jinn* of serpent form (Robertson Smith, *Religion of the Semites*, p. 168). The following extract from Ambrose Pary shows that the virtue of theriac in curing the bites of poisonous animals was ascribed to the viper's flesh that it contained, like being supposed at that time to cure like. "At Galeni authoritas (*Lib. de the.*) eam opinionem convincit, scribit enim theriacam si huic vulnerum generi ante imponatur, quàm venena ad partes nobiles pervenerint, magno præsidio esse. Convincit et ratio: theriacæ enim compositionem viperina caro subit, quæ substantiæ similitudine allicit, et ut magnes ferrum, aut ambra paleas evocat." (*Opera Chirurgica*, Frankfort-on-Main ed., 1594, p. 580).

2 Manget's *Bibliotheca Chemica Curiosa*, Geneva ed., 1702, II, p. 49. Manget prints 'Tyriaca' for 'Theriaca' throughout the passage quoted.

To this may also be added the statement of the 11th cent. Syrio-Arabic MS. (Duval's trans., Berthelot, *La Chimie au Moyen Âge*, II, pp. 182 and 183.

"L'élixir ressemble au poison, à cause de sa violence et de sa subtilité; car il altère et dénature des corps nombreux et agglomérés, lorsqu'on fait agir sur eux une petite quantité de cet élixir.

"Il ressemble à la thériaque à cause de sa force et de son utilité, car il fait revivre les corps atténués et réduits à l'état devisé."

The comparison of the elixir with a poison was a Greek idea, *Ἰός* being a synonym amongst the Alexandrian alchemists both for the Elixir and also for the product of the combustion ('killing') of metals (cf. Berthelot, *Collection des Anciens Alchimistes Grecs*, I, Introd., p. 254).

3 *Viz.*, Earth, Air, Fire and Water.

4 The idea is the same as that of the Greek olive-farmers alluded to by Palladius. "With ancient Greek husbandmen it was a maxim that olives should always be planted and gathered by pure boys and virgins; the uncommon fruitfulness of the

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sanguine, et de 4. humoribus, et fumus capillorum reddit cuprum de colore auri. Valitudines eorum multæ sunt: quia faciunt de eis [per] botum barbatum,[1] mixti tamen cum terra magisterii.[2] Intellige."[3]

"Postquam scis lapidem, dicam tibi tempus colligendi et de quibus debes colligere. Tempus est illud in quo colligis sanguinem et ova, scilicet Martius, Aprilis, September et October:[4] quia in illo tempore sunt humores æquales, et de quibus colligas sunt pueri 6. annorum usque ad 15. annorum [usque ad 30. ut dicit Adimuerat], et non habeant in seipsis humorem majorem; et capilli qui non sint nec albi, nec nigri, nec rubei, nec citrini, nec grossi, nec tenues, nec crispi, nec plani, nec de fœmina; sed sint æquales in totis suis proprietatibus.

"Ablutio. Et postquam collegeris, debes lavare illos in aqua salsa, et agita ibi eos, donec sint albi."[5]

Nothing could be plainer from these quotations than that the virtue of the hair lay in its supposed magical qualities; while at the same time they afford some indications of the ways in which the more strictly alchemical properties of hair were utilised.

The two that the writer specially signals out for notice (beyond the curious statement that the fumes of hair turn copper yellow[6]) are (*a*) its employment in the manufacture of lutes and crucibles; and (*b*) the utilisation of the fact that the aqueous distillate of hair possesses the property of attacking or 'killing' mercury. Of those included under the phrase 'multæ valitudines,' and referred to elsewhere in the *De Anima*, there may also be mentioned (*c*) the use of hair in the manufacture of brass; and (*d*) its value as a 'cerating' agent.

In the first of these cases, the admixture of hair with the clay, though primarily made, no doubt, on account of its binding qualities, probably affords another indication of a belief in its magical virtues, since any sort of vegetable fibre would have served as well. The Egyptians of the time of Ramses II used straw in the manufacture of bricks, while at the present day, a bearer in a chemical laboratory in India, if told to lute on a crucible lid, will mix jute with the moist clay that he intends to use for the purpose.

The employment of hair in the preparation of brass will be best understood by a quotation of the receipt given on p. 307 of the *De Anima*.

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olive-trees at Anazarbus in Cilicia, was attributed to their being tended by young and innocent children" (Frazer, *Golden Bough*, II, p. 211): cf. also *antea*, p. 27, note (9); p. 35, note (1); and next paragraph of text.

[1] The *būṭ-bar-būṭ* (بوط بر بوط 'crucible on a crucible') mentioned by the author of the *Mafātiḥu-l-'Ulūm* and other authorities of the same time as a common piece of alchemical apparatus. The description given in the *Mafātiḥu-l-'Ulūm* (*ed. cit.*, p. 256) is as follows: "It consists of two crucibles, one placed on the other, the upper having a perforated bottom, and the joint between the two being well luted with clay. The body to be purified is melted in the upper crucible, and drops through into the lower one; while the dross and impurity remains behind." A description of the apparatus is also given on p. 339 of the *De Anima*.

[2] The *Ṭīnu-l-Ḥikmah* ('Clay of Wisdom') of the Arabs. This was generally a mixture of stone-free clay with chopped hair and dung (cf. Berthelot, *La Chimie au Moyen Âge*, II, pp. 152 and 166).

[3] *De Anima*, Dictio V, Cap. XX (*Artis Chemicae Principes*, *ed. cit.*, p. 151).

[4] Spring and Harvest, when the Spirits of Nature are strongest and most active (cf. Frazer, *op. cit.*, III, § 8, *passim*).

[5] *De Anima*, Dictio VII, Cap. III (*op. cit.*, p. 414).

[6] Cf. also *antea*, p. 35. The copper is actually blackened.

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"Accipe de tutia[1] unam libram, de capillis hominis libram semis, pisa totum, et fac cum aceto distillato, et fac panes de tribus unciis, et sicca ad solem, et cum fuerint sicci, accipe de cupro tres libras, et funde, et jacta ibi duos panes, et agita tantum, donec bene misceatur, et jacta in foveis, et est bonus modus."

The remaining cases merely represent different aspects of a single reaction, since the mixture of compounds produced by the agency of the aqueous distillate from hair was also found to possess the property of readily melting—without any evolution of fumes—when dropped on to a heated metallic plate. Substances answering to this test were said to be 'cerated,' and owing to their loose combination, their particles were supposed to be peculiarly accessible to the transmuting influence of the Elixir.[2]

As regards the actual chemistry of the reactions, there can be little doubt that it depended almost entirely on the ammonium salts that were generated during the combustion of the hair. Cases (*a*) and (*c*) are instances of the use of ammonium chloride[3] as a flux, while in (*b*) and (*d*) the chemical reactions that occur are the formation of a chloride (or sulphide), followed in all probability in the case of mercury by the conversion of the compound first produced into a readily fusible ammonium double salt.[4] It is easy, therefore, to understand—once the belief in the magical equality of hair and its crystalline derivative was supported by proof of their alchemical equivalence—how ammonium chloride quickly usurped the place of hair in alchemical operations. Since sal-ammoniac, when heated in a confined space, often acts like gaseous hydrochloric acid,[5] substances were found to be as easily attacked as if hair had been used—or probably even more so; whilst many of the products of the reaction with sal-ammoniac, *e.g.*, Silver Chloride, were obtained without need of any further treatment in the desired state of ceration.

There is, in fact, a marked parallelism between the history of hair and sal-ammoniac in medicine and alchemy. Just as in the case of medicine the introduction of sal-ammoniac was aided by its physiological effect, so in alchemy the chemical properties of the salt greatly facilitated its adoption. In medicine the idea of the ancient doctor was to oust the spirit of disease by a health-giving human spirit. The object of alchemy, where man takes the place of nature in perfecting a base metal into gold, was to endow the base metal with a soul or spirit (in early alchemical writings, the terms are practically synonymous), whereby it would be forthwith transformed into gold.[6] Fostered as Arabian

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[1] On p. 304 of the *De Anima*, the following definition of Tutia occurs. "Tutia est una materia de terra naturali, afferunt etiam de Ægypto; et quia lapis ille tingit latonem de tali colore, dicunt quod est unus ex lapidibus," *i.e.*, one of the 'Stones' of the alchemists, cf. p. 28 *antea*. Tutia was apparently, therefore, Zinc Oxide, or Carbonate.

[2] *E.g.*, "Signum perfectionis salis hoc erit, si illius granum in laminam argenti ignitam projectum, statim liquabitur. . . . sine ulla expiratione in vaporem (*Theatrum Chemicum*, 1659 ed., IV, p. 408).

[3] Practically speaking, the ammonium salts may be taken as equivalent to ammonium chloride, as in most alchemical operations common salt seems to have been added in addition to the other reagents (cf. the *De Anima, passim*); also *antea*, p. 28.

[4] *E.g.*, Fusible White Precipitate ($NHg_2Cl.3NH_4Cl$), made by the joint action of ammonium carbonate and ammonium chloride on mercuric chloride.

[5] Cf. Watts' *Dictionary of Chemistry*, Morley and Pattison Muir's ed., 1888, Vol I, p. 202, where examples are given of the interaction of ammonium chloride with both metals and oxides.

[6] Ibn Khaldūn, *trans. cit.*, III, p. 207. The Malays still believe that Gold and Tin possess personal souls, which must be conciliated before the prospector can hope to find the metals in any quantity (Skeat, *Malay Magic*, pp. 266 and 271).

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alchemy was, under the theistic influences of Ṣūfiism,[1] nothing was likely to be more esteemed as a source of alchemical energy than the human spirit, and accordingly we find the hair (in addition to all other parts of the human body with which spirituality was associated), in full use among the early Arabian alchemists. Subsequently, for the reasons just indicated, the place of hair was largely taken by sal-ammoniac,[2] but, as is evident from the methods employed in its preparation, the magical associations that led to its adoption did not altogether pass into oblivion.

The reasons that brought about the introduction of ammonium chloride into alchemy have now been sufficiently dealt with, and I only propose to add a brief discussion of the source from which the Arabs obtained their knowledge of the alchemical properties of this important substance.

Passing over the improbable assumption that Jābir discovered these properties for himself,[3] the Greek school of Alexandria was the first to suggest itself. Against this, however, the objection may at once be made that hair and sal-ammoniac are barely mentioned by Greek alchemists.[4] Of the Persian school of alchemy, we know little more than that it existed in the early centuries of our era;[5] while India is ruled out of the discussion by the fact that the Sanskrit name नवसार, *navasār*, for sal-ammoniac is of alien origin.[6] Finally an etymological analysis of the Chinese and Arabic names for the salt suggested a possible solution of the problem.

The only derivation of the Arabic *Nūshādur* that has come to my notice, is that it is a corruption of two Persian words دارو نوش *nūsh dārū*, 'life-giving medicine.' This etymology, though of a suspiciously popular character, might have been accepted were it not for the fact that the Chinese name for sal-ammoniac is 硇砂, *nau-sha*.[7] It is hardly likely that if the Chinese had drawn their name for ammonium chloride from the Persian, they would have dropped half of the original name; whereas if the Persians had taken the Chinese name, it is conceivable that the word دارو *dārū*, 'medicine,' might have been suffixed to the Chinese original. Hence the decision seemed to lie in the etymology

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1 Jābir was a Ṣūfī, *e.g.*, the *Fihrist* of Ibn Abī Yā'qūb an-Nadīm (written in 988 A.D.), Flügel's ed., p. 355.

2 Cf., *e.g.*, the *De Anima*, *passim*.

3 Jābir wrote a *Kitābu-ḵh-Ṣha'r* ('Book on Hair'). Alchemical pamphlets dealing with 'Plants,' 'Animals,' 'Blood,' 'Urine' and 'Eggs,' are also recorded from his pen (cf. *Fihrist*, *ed. cit.*, p. 356).

4 The most noticeable reference to a Greek belief in the virtue of hair is a parable of Hermes, quoted, ostensibly from a lost work of Al-Fārabī (the master of Ibn Sīnā; † 950), in the *De Anima* (*ed. cit.*, p. 55). Hermes is represented as taking his son on his shoulder and exclaiming 'The Stone is in him' meaning thereby—so the commentator says—'in his hair and blood.' It is, to say the least, doubtful, and not supported from actual Greek authorities.

5 A treatise written in Pahlawī by an alchemist named Jāmāsb, for Ardashīr, the founder of the Sāsānian dynasty (226–241 A.D.), is recorded in Ḥājī Khalfa's *Kashfu-ẓh-Ẓhunūn* (Flügel's ed., III, p. 384).

6 Cf. Rāy, *History of Hindu Chemistry*, p. 54, note (1).

7 Hanbury, (*Pharmaceutical Journal*, VI, 1865, p. 514) has shown that though occasionally common salt is offered as a substitute, the true *nau-sha* of the Chinese is ammonium chloride. It is said in Pekin to be obtained from certain volcanic springs in the province of Sze-chuen, and in Tibet. The first notice of the similarity between the Chinese and Urdu names for sal-ammoniac, is due to Porter Smith (*Materia Medica and Natural History of China*, Shanghai; and Trübner, London, 1871, p. 190). I should add that I am indebted to Mr. D. Hooper of the Economic Section of the Indian Museum for affording me an opportunity of quoting the details of Hanbury's papers that are given in this and the following note. Porter Smith only makes very casual references to Hanbury's work.

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of the Chinese word. If it can be shown to consist of Chinese roots, the word *Nūsẖādur* is probably of Chinese origin; if not, the Persian etymology may be accepted.

As regards the second portion of the name, Porter Smith in the preface to his *Materia Medica and Natural History of China* states that the character 砂, *Sha*, is connected with, and yet differentiated from, the character for 'Stone' 石 *Shih*. This has been kindly verified for me from Chinese dictionaries by Mr. K. Ohmiya, a Japanese gentleman now resident in Calcutta, though he is unable to agree with Dr. Porter Smith's extension of the meaning into an expression of the appearance and condition of a more or less perfectly crystallised salt. Mr. Ohmiya has also been good enough to ascertain from the same source of information that the character *Nau*, consists of 鹵 to which the meaning 'natural salt' is given; together with 石 the determinative for 'Stone.' The syllables *nau-sha* appear, therefore, to be capable of complete analysis into Chinese roots.

We are accordingly led to the conclusion that the word *Nūsẖādur* is probably the Chinese *nau-sha*, suffixed by the Persian word *dārū*. The Sanskrit *navasār* would also seem to be simply the Chinese name in a slightly altered form.

No final opinion on the subject can be given without a careful study of the writings of the Chinese school of alchemists that flourished between 200 B.C. and 400 A.D., but this, unfortunately, is out of the question in India.[1] It may, however, be added that the author of the *Fihrist* (written at Baghdād in 988) mentions China amongst the countries for which the honour of being the birth-place of Alchemy was then claimed;[2] while if it is found on investigation that the Chinese alchemists employed hair and sal-ammoniac in their operations, there is no difficulty in accounting for the subsequent dissemination of their knowledge, since the first Arab embassy visited the Court of China in 651 A.D.,[3] *i.e.* 100 years before the time of Jābir. India too was in constant communication with China from 66 A.D.

I desire to express my great indebtedness to Maulawī Hidāyat Ḥusain, of the Calcutta Madrasah, for his willing help during the preparation of this paper. I have also to thank Dr. N. Annandale, Deputy Superintendent of the Indian Museum, (at whose request the paper was begun), for the valuable criticisms and suggestions that have so greatly eased my labour in a somewhat unfamiliar field.

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[1] Even Edkin's paper (*Trans. of the China Branch of the Royal Asiatic Society*—Hong Kong—Part 5, 1855, Art. IV) is not available in Calcutta. I have chiefly drawn my information regarding this Chinese School from Hanbury's account of Edkin's paper, in his *Notes on Chinese Materia Medica* (*Pharm. Journ.*, II, 1860-1861, p. 115), as well as from various references in Bretschneider's *Botanicon Sinicum*. The chief alchemist of the school was Ko-Hung, who died in 330 A.D.

[2] *Ed. cit.*, p. 259.

[3] Bretschneider (*On the Knowledge possessed by the Ancient Chinese of the Arabs and Arabian Colonies*, Trübner, 1871, p. 8, quoting from the Annals of the T'ang Dynasty.

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ERRATA.

Page	I,	line 34,	*for* ebullation *read* ebullition.
,,	I	,,	40, *for* rice *read* rue.
,,	II	,,	13, omit comma after the word milk.
,,	,,	,,	19, *for* La Chinie *read* La Chimie.
,,	,,	,,	31, *for* seeds *read* reeds.
,,	,,	,,	35, *for* afflicated *read* afflicted.
,,	III	,,	7, *for* divideded *read* divided.

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Appendix to Mr. Stapleton's Paper, Sal-Ammoniac : a Study in Primitive Chemistry.

Translations of Passages quoted in Latin and French.

As the Editorial Committee of the "Memoirs" feel that there will naturally be members of an Indian society to whom the passages quoted by Mr. Stapleton in Latin and French will be unintelligible, and as the author of the paper is not at present in Calcutta, I have added translations (for which Mr. Stapleton is in no way responsible) of these passages in an appendix to be issued with the paper.

N. ANNANDALE,

Anthropological Secretary of the Asiatic Society of Bengal.

I. pp. 25-26 (from Pliny, *Hist. Nat.*, Book xxxi, Chapter 39).

"King Ptolemy discovered [native salt] near Pelusium while preparing a camp. Then, following this example, men began to find it by digging in the sand in the waste places between Egypt and Arabia; likewise in dry localities throughout Africa as far as the Oracle of Ammon. (This substance grows with the phases of the moon by night.) The country about Cyrene is famous for its "Ammoniac," so called because it may be found beneath the sand (Greek *ammos*). In colour it resembles the *aluminum* called "split *aluminum*," growing in long pieces, not being transparent, having an unpleasant taste, but being efficacious in medicine. The quality considered best is very clear and has a straight cleavage. A notable thing is told of it, namely, that while it remains in the cavities in which it originates it is extremely light, but that when brought out into the glare of day it immediately increases in weight to an almost incredible extent. The reason why is obvious—the damp exhalations of the mines buoy it up as water would do. It is commonly adulterated with the Sicilian salt we have called Cocanic; also with that of Cyprus, which is extraordinarily like it. Salt is also dug in Spain beyond Egelasta, being found in lumps which are barely translucent. Nowadays most doctors give this kind the palm over all others. Wherever salt is found the soil is barren and produces nothing. So much for salt which appears spontaneously."

II. pp. 28-29 (from the '*De Investigatione Perfectionis*').

The preparation of sal-ammoniac.—Sal-ammoniac is made of five parts (or two) of human urine, one part of human sweat, one of common salt, and one-and-a-half parts of the soot from logs or from sticks heated to dryness with all that appertains to them. Sublime therefrom the true and efficacious sal-ammoniac, dissolve again in sweat, congeal, and sublime once more from common salt: the preparation is then complete. Or let it be first triturated with a preparation of purified common salt, then sublimed in a tall *aludel* until it is entirely extracted pure; then let it melt in a porphyry vessel (?) in the open air, if this can be done with its natural water. Otherwise, preserve it sufficiently sublimed and pure.

III. p. 29 (from Leclerc's French translations, Vol. iii, p. 380).

IBNU-T-TILMĪDH.—There are two kinds of it, a natural and an artificial salt. The natural kind comes from hot springs in the mountains of Khorassan, which are said to have a very intense ebullation. The natural salt is the better of the two.....and is as clear as crystal. EL-GHAFEKY.—It is a kind of salt.....It is so strongly saline that it bites the tongue sharply. There is also a kind which is produced from the soot of baths, especially of baths heated by means of dung fires.....It is efficacious against spots on the eyes, prevents the falling forward of the uvula on the gullet, and is useful in the case of sore throats. Dissolved in water and poured out within a dwelling, it scares away reptiles; poured into their lair, it kills them. Triturated with rice water and taken into the throat, it kills blood-suckers. SHERIFF EL-EDRISSY.—Prepared with oil

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and rubbed on in the bath over an itch of the atrabilious kind, it causes the disease to disappear. Masticated and projected into the mouths of snakes and vipers, it kills them instantaneously. Mixed with oil of eggs and used as an ointment for white leprosy, after preliminary lotions, it cures the disease, especially if the treatment is prolonged."

IV. pp. 34-35 (from Leclerc's French translations, Vol. II, pp. 334-335.)

Ar-Rāzi in *The Continent*.—Athour the Wise says that man's hair soaked in vinegar and applied to the bite of a mad dog, cures it in a moment. Soaked in pure wine and oil and applied to a wound on the head, it prevents inflammation. The smoke of burnt hair inhaled combats hysteria and uterine discharges. Burnt hair triturated with vinegar is applied with benefit to pimples. Triturated with honey and used as an embrocation in the case of aphtheses of children, it has a marked success. If it is triturated with incense and spread on sores on the head after anointing them with pitch, or even if it is beaten up with honey and applied to the sores. it cures them. If burnt hair is triturated with litharge and rubbed in for the itch and for irritation of the eye, it causes them to pass away. Burnt hair triturated with sheeps' milk, butter and rubbed in on ecchymoses and swellings caused by flies, is a certain remedy. Mixed with oil of roses and injected into the ear it cures ear-ache. Ibn Zuhr's *Properties*.—The hair of a young infant, before it has acquired consistency, carried on his person by a man who is gouty or has been stung by a scorpion, relieves him and takes away the pain. Fumigation with human hair makes objects which the smoke reaches yellow. Water distilled from it rubbed on the head, causes hair to grow.

V. p. 35 (from Berthelot's *La Chimie au Moyen Age*, Vol. II, p. 155).

"We can bring it about that a vegetable turns into an animal, and that an animal produces another (kind of) animal. Take, for example, hair. When human hair putrifies, after a time it becomes a living snake. In the same way, ox's flesh changes into bees and hornets; eggs become dragons; ravens engender flies. Many things in putrifying and changing engender different kinds of animals. From the putrefaction of plants certain animals originate. Basil, as it putrifies, engenders venomous scorpions. In the same way a great number of plants produce animals as they putrify and change."

P. 35 (from the same work, Vol. III, p. 255).

"We have seen several times over, that it is possible to create animals without knowing the specific differences between them; with earth and straw it is possible to cause scorpions to be born, and with hair, to make snakes. Take a further case (of artificial production) mentioned by authors who deal with agriculture: when bees become scarce, a swarm can be extracted from the dead body of a calf. Let us also cite the way in which seeds are produced by planting the horns of hoofed animals, and how sugarcane is produced by filling the horns with honey before planting them."

VI. pp. 36-37 (from the *Pretiosa Margareta Novella*).

"Thus also this stone works in leprous metals, and therefore it is sometimes called poison, sometimes the "Antidote." For the corrupt metals, which are four, are afflicated by four kinds of leprosy, from one or other of the four corrupt humours, and their disease is cured by the said stone, just as human leprosies are cured by the right kinds of snakes.....Gold, however, is the purest metal, and the noblest, and of the evenest humour, like the sun among the stars, and like the pure blood in the body of a man of temperate complexion, lacking all extraneous matter and having in itself the sum of health. And so art, following nature, wishes to cure all things with this stone [it is both poison and the "Antidote"] and to transform them into gold alone, as nature does. ..... Hali says too in his *Secrets*, "This is the red sulphur, shining in darkness. It is the red hyacinth, the flame of venom, the murderer and the victorious lion, the evil-doer, the cleaving sword, the Antidote healing all infirmity," etc. ..... Haly says, "This stone is the life of the dead and their reformation: it is also a medicine which preserves and purges

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the body," etc. ..... Morienus says, " The elixir, however, is a medicine composed of several ingredients, and verily this medicine heals the weaknesses of the metals, just as the " Antidote " heals the weaknesses of men. Hence it is often called poison by some; because, just as poison in the human body, so the elixir in the metallic body," etc.

VII. pp. 37-38 (from the treatise " *De Anima.*")

Abuali said; " I will speak in this chapter about hair. Its nature is cold and dry, and it enters into this mastery. If it is divided into its four parts, the water thereof hardens mercury. Hair is of many kinds, hair of a tall man, of a short man, of a middling man, of beasts; but that of beasts does not enter into this mastery and the concern thereof is of human hair, both of black and of yellow complexion (?) of phlegmatic and of sanguine humour. Now the hair which enters into the mastery of the getting of the " stone " is that of youths of 13 years, who are sanguine, of the four humours, and the smoke of their hair makes copper of the colour of gold. Its powers are many; because they make of it by the *būṭ-bar-būṭ*, mixed, nevertheless with the earth of the mastery. Understand (the matter, if thou cans't).

The Ablution thereof.—And after thou hast collected it (the hair), thou must wash it in salted water, and shake it, until it be white.

VIII. p. 39. (from the *De Anima*, p. 307).

" Take of " *tutia* " one pound, and of human hair a pound-and-a-half, grind it thoroughly, have it distilled with vinegar; make thereof cakes of three ounces; dry in sunlight. When they are dry, take of copper three pounds, melt it and cast therein two of the cakes; shake it a little, until it is well mixed, and spread it out in small pits. This is the right way.

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